REMARKS

Applicants wish to thank the Examiner for the courtesies extended during the telephone conversation on February 29, 2008. The rejected claims 5-7 and 9-11 were discussed with respect to the obviousness rejection under 35 U.S.C. 103(a) over Japanese Patent Application No. JP 10287753 in view of U.S. Patent No. 6,114,495 (Patent '495) to Kolstad et al. Examiner Johnson acknowledged that the arguments presented during the telephonic interview could potentially distinguish the claimed invention over the cited art with respect to polylactic acid branching and tensile strength. Upon the Examiner's request, the applicants respectfully provide herein a detailed response distinguishing these elements in greater detail. Applicants believe that in view of the telephonic discussion and this paper, the Examiner will find that the application is in condition for allowance. Reconsideration and withdrawal of the pending rejections are respectfully requested.

Status of Claims

Claims 5-7 and 9-11 are pending after entry of this paper. Claims 5-7 and 9-11 have been rejected. Claims 1-4, 8, and 12-77 have been cancelled without prejudice. Applicants reserve the right to pursue cancelled claims in a divisional or continuing application.

Claims 5 and 6 have been amended to clarify that the term "inert content" defines the state of the composition and not a component. Support may be found throughout the instant specification, for example, see Paras. [0066], [0100] and [0118].

No new matter has been introduced by these amendments. Reconsideration and withdrawal of the pending rejections in view of the above claim amendments and below remarks are respectfully requested.

Response to Rejections under 35 U.S.C. §103

Claims 5-7 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese Patent Publication No. JP 10287753 (JP '753) in view of U.S. Patent No. 6,114,495 to Kolstad, et al. (Kolstad). The Examiner maintains that JP '753 discloses a polylactic acid composition polymerized by combining the lactic acid L-isomer with a tin octoate catalyst in the amount of about 1 to 30 ppm that has a weight average molecular weight of 200 kDa or more. The Examiner admits that JP '753 fails to discuss the polymerization process and the desired viscosity of the material, which are allegedly made obvious by the disclosure of Kolstad. In the most recent Office Action, dated December 28, 2007, the Examiner further contends that since the inert content can potentially range from 0 to 3 %, "it cannot be assumed that inert compound [*sic* – content] is there if it is not mentioned." Applicants respectfully disagree.

As an initial matter, applicants respectfully wish to clarify the apparent misunderstanding of the term "inert content" as recited in claims 5 and 6. According to the Examiner, inert content allegedly represents additional compounds or substances (Office Action – page 3). However, applicants have readily explained in the instant specification (see paras. [0066], [0100] and [0118]) and also in the response to an Office Action dated October 25, 2005 that "inert content" is an index that relates to uniformity and evenness in thickness of the

multifilament in the longitudinal direction. For example, a yarn with a high inert content percentage has a high concentration of fibers with irregular linear density. Therefore, a multifilament yarn with less than 3% inert content as claimed has an excellent level of heat stability, high spinnability, and homogeneousness. Applicants, however, present additional arguments to overcome the obviousness rejection.

Contrary to the Examiner's contention, the combination of prior art either explicitly or inherently, does not teach each and every element of the claimed invention as presented in independent claims 5 and 6. It is well known in the art that polylactic acid (PLA) is significantly advantageous for being derived from renewable resources and biodegradable. However, the rheological properties of these polymers are such that they can be difficult to process (See instant para. [0004]). This difficulty in processing has limited the use of these polymers partly because poor rheological properties lead to problems with spinning, drawing, false twisting, etc.

The applicants have determined that these issues can be overcome by a cooperative relationship or synergy of the following elements of the composition (1-4):

1) PLA resin that forms a linear structure - agents such as trivalent or quadrivalent alcohol and carboxylic acids potentially create the branched structure in the polymer material;

2) content of L-isomer lactic acid is equal to or greater than 98 mol %;

3) Sn (tin) content is less than 30 ppm;

4) residual monomer content is not more than 0.5 weight %;

and parameters (5-8) that further define the claimed invention (See MPEP 2173.05(g)), which are essential to produce a high quality multifilament that overcomes poor rheological properties has:

5) inert content of less than 3%;

6) relative viscosity (ηrel) of 2.7 to 3.9;

7) tensile strength of 3.9 cN/dtex or more; and

8) contraction ratio in boiling water of 12% or less.

The combination of JP '753 with Kolstad does not teach each and every element of the claimed invention with respect to the linear structure of PLA and a tensile strength of 3.9 cN/dtex or more. It is well recognized in the art, as disclosed in para. [0012] of the instant specification, that a polycarboxylic acid produces a branched structure in the polymer material, which according to Kolstad increases chain entanglement and broadens the molecular weight distribution of the polymer, both desirable properties (col 25, lines 28-33).

Applicants present in the below table the properties and characteristics of experimental multifilament fibers to demonstrate the differences between the claimed invention and PLA fibers in the art, namely JP'753. In particular, applicants emphasize the resulting differences between a branched and linear structures with respect spinning ability, fluff generation, productivity of filament, tensile strength, contraction ratio in boiling water, peak temperature of thermal stress and fatigue after dyeing. Example 6 represents the claimed invention which has no branching (*i.e.*, linear structure). Examples 10 and 13 represent comparative examples with branched PLA polymers as presented in the instant specification. Although applicants present multiple examples, not all of them are applicable. For instance, Examples 7, 11, 12 and 14 have lower than claimed L-isomer mole percent, therefore not used in the comparison with Example 2 of JP '753. The following table reproduces the examples presented in the instant specification and JP'753. Example 2 of JP'753 describes the properties of the branched structure similar to comparative Examples 10 and 13.

Example No.	6	10	13	2 of JP'753
Structural Elements				
(1) Branched Structure	**No**	**Yes**	**Yes**	**Yes**
Carboxylic Acid (% mol)	**0.00**	**0.10**	**0.10**	**0.10**
(2) L-isomer (mol%)	**98.7**	**99**	**98.7**	**~99**
(3) Sn Content (ppm)	**18**	**19**	**18**	**~20**
(4) Monomer Content (% by wt)	**0.27**	**0.26**	**0.24**	**unknown**
Functional Elements				
Mw	$14.6X10^4$	$14.8X10^4$	$24.0X10^4$	$20.9X10^4$
Mn	$7.2 X10^4$	$7.6 X10^4$	$12.4 X10^4$	
Relative Viscosity (ηrel)	3.02	3.04	4.03	
Spinning Temperature (°C)	230	230	245	
Decrease of Viscosity (%)	3	6	20	
Spinning speed(m/min)	3500	3500	3500	
Spinning Ability 1	Very Good	Good	Poor	
Spinning Ability 2	≥7	4	3	
Draw temperature(°C)	110	110	110	
Draw magnification factor	1.7	1.7	1.7	
Set temperature(°C)	145	145	145	
Spinning Ability 3	Very Good	Good	Poor	
Fluffs	**uniform**	**irregular**	**irregular**	
Productivity of Filament	Very Good	Poor	Poor	
Tensile Strength (cN/dtex)	**4.43**	**3.51**	**3.41**	
Elongation (%)	30.3	29.6	29.8	
Contraction Ratio (%)	9.8	10.2	10.2	
Birefringence Δn	0.035	0.0276	0.0266	
Temperature of thermal stress(°C)	**90**	**82**	**82**	
Fatigue after dyeing	**Very Good**	**Poor**	**Poor**	

With respect to the first four elements in the table above, the difference between Example No. 6 and the other Examples is the absence or presence of branching. Since Examples 10 and 13 have similar characteristics to the branched JP'753 Example 2, applicants utilize the comparative examples 10 and 13 to support the findings that the claimed invention as disclosed in Example 6 is novel and not obvious in view of the JP'753 publication.

The polymers having a branched structure, *i.e.*, Examples 10 and 13, produce poor spinning ability while generating undesirable irregular fluffs. Furthermore, the tensile

strength of the branched fiber (Examples 10 and 13) is less than 3.5 cN/dtex, which is smaller than that of the fiber having no branched structure, *i.e.*, 4.43 cN/dtex (Example 6). Moreover, the peak temperature of thermal stress in branched fibers is less than 85°C. Taken together, the decrease in these properties weakens the fiber to the point of causing fatigue of dyeing to make the fiber practically inapplicable for production of the multifilament yarn (page 28, paragraph [0132] of the instant specification). Thus, "the branched structure of the polylactic acid composition has a far more negative effect on spinning work efficiency than the conventional synthetic fiber." In fact, "the polylactic acid composition containing even a trace amount of the branched structure has poor spinning work efficiency and smaller tensile strength as compared with the composition having no branched structure." (para. [0166]; emphasis added).

Kolstad, on the other hand, does not compensate for the deficiencies of the JP '753 application. The Examiner has combined Kolstad with the JP'753 publication for the alleged teaching of the desired relative viscosity, i.e., 2.7-3.9. However, Kolstad does not even relate to the same polymer composition as disclosed in JP'753. The Kolstad composition requires (a) a polylactic polymer of specific molecular weight, (b) a specific amount of lactide, and (c) a catalyst deactivating agent, which is, for example, a multifunctional carboxylic acid such as tartaric acid or polyacrylic acid (see col. 14, lines 13-40 and col. 15, lines 4-42). The multifunctional carboxylic acid as described above causes PLA polymer branching (para. [0012] of the instant specification). Applicants respectfully direct the Examiner's attention to the above comparative experiments, where a polylactic acid composition containing even a trace amount of the branched structure has poor spinning work efficiency and lower tensile strength as compared to the composition having linear structure (par [0166]). Kolstad describes branching as a preferred means for improving the melt viscosity and degree of polymerization (Col 25, line 8 to

Col 26, line 17), while not addressing the issue of poor spinning work efficiency and decreased tensile strength.

Furthermore, as the Examiner is well aware, a prior art reference must be considered in its entirety, including disclosures that teach away from the claim (MPEP 2141.02(VI). As an initial matter, it is known in the art that the yellow coloration of the polymer resin is highly undesirable, where the fiber becomes unusable. The JP '753 publication requires the used of a polycarboxylic acid (para. [0015] of JP'753) that produces a branched polymer structure, *i.e.*, non-linear, in order to avoid yellow coloration of the PLA resin. Specifically, the JP '753 publication clearly discloses using a polycarboxylic acid (para. [0015] of JP'753) in a concentration of approximately 0.001-1 weight % of the lactide (Abstract) to produce a colorless PLA resin applicable in a "fiber, various films, etc. for garments" (para. [0036] of JP'753). In fact, if no polycarboxylic acid is added to the JP'753 composition as shown in comparative example 2, the PLA resin becomes yellow and unusable (para. [0031]). Therefore, one skilled in the art reading JP'753 publication would be encouraged to use polycarboxylic acid to avoid problems associated with coloration as described in the JP'753 composition. Thus, the JP'753 publication teaches away from using claimed PLA resin that forms a linear structure. An artisan would not have sufficient guidance from reading the combination of cited art to select the appropriate composition elements and parameters. Moreover, a significant amount of undue experimentation would be necessary in order to ascertain which components and/or parameters would need to be adjusted in order to arrive at the claimed multifilament yarn having the linear structure exhibiting the desirable properties as claimed.

Therefore, contrary to the Examiner's contention, the claimed fiber and the JP'753 fiber are different for not using the same type of PLA resin, *i.e.*, linear vs. branched, and

having different tensile strength. Thus, one skilled in the art could not make and use the multifilament yarn of the claimed invention by employing the polylactic acid composition of the JP '753 application, even in combination with Kolstad. One skilled in the art would still be motivated to use carboxylic acid to avoid the yellow coloration of the resin and to improve melt viscosity and degree of polymerization, thereby introducing branching into the PLA resin. Whereas, the instant claims explicitly require a linear polyactic acid resin in order to produce the inventive multifilament yarn, because the branched structure in the polylactic acid composition results in decreased tensile strength, poor spinning ability, generation of undesirable irregular fluffs, decrease in peak temperature of thermal stress and fatigues of dyeing, thus making the fiber practically inapplicable for production of the multifilament yarn (para. [0166]).

The combination of the JP '753 publication and Kolstad does not satisfy each and every element of the claimed invention as recited in independent claims 5 and 6, since the resultant fiber does not satisfy at least a requirement for a linear polymer, to arrive at the claimed multifilament yarn. Applicants respectfully request reconsideration and withdrawal of the 35 U.S.C. §103(a) obviousness rejection in view of the above arguments.

Claims 9-10 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Japanese Patent Publication No. JP 10287753 in view of U.S. Patent No. 6,114,495 to Kolstad et al as applied to claim 5, and further in view of U.S. Patent No. 6,174,602 to Matsui et al. Applicants respectfully disagree.

Claims 9 and 10 are directed to a process for producing the claimed multifilament yarn using a linear polylactic acid resin. As demonstrated above, the combination of JP '753 with Kolstad does not teach each and every element of the claimed invention as disclosed in

claims 5 and 6, since both use compositions that produce branching instead of the linear structure of PLA. Furthermore, the JP '753 publication requires a polycarboxylic acid (para. [0015]) to produce a colorless PLA resin. Because neither JP'753 nor Kolstad disclose the claimed multifilament yarn, neither reference teaches the claimed process, nor is there motivation for the skilled artisan to modify the teachings of the JP'753 or Kolstad to result in the linear structure as claimed.

The Matsui reference, on the other hand, does not compensate for the shortcomings of JP'753 and Kolstad. The December 27, 2004 Office Action alleges that it would have been obvious to one of ordinary skill in the art to use the extrusion process described by Matsui with the polylactic acid polymer of JP '753 since Matsui discloses how to produce filaments from polylactic acid polymers. Furthermore, the Examiner alleges that it would have been obvious to one of ordinary skill in the art to optimize the temperature range of the drawing and heat treating steps to produce filaments with a crystal structure that is oriented during the drawing step and then heat treated after the drawing step to permanently set the changes produced during drawing the finished filament. (Office Action of December 27, 2004, at page 5). Applicants respectfully disagree.

Applicants assert that the combination of JP '753, Kolstad and Matsui does not teach, disclose, or suggest the processes claimed in claims 9 and 10. Specifically, applicants respectfully assert that Matsui does not cure the deficiencies of JP '753 noted in the previous subsection. Thus, applicants contend, that the proposed combination of references fails to teach, disclose, or suggest all of the claim elements of applicant's invention, *i.e.*, a linear PLA resin. For at least these reasons, reconsideration and withdrawal of the rejections of the claims 9 and 10 are respectfully requested.

Dependent Claims

The applicants have not independently addressed all of the rejections of the dependent claims. The applicants submit that for at least similar reasons as to why independent claim 5 from which all of the dependent claims 7 and 11 depend are believed allowable as discussed *supra*, the dependent claims are also allowable. The applicants however, reserve the right to address any individual rejections of the dependent claims and present independent bases for allowance for the dependent claims should such be necessary or appropriate.

Thus, applicants respectfully submit that the invention as recited in the claims as presented herein is allowable over the art of record, and respectfully request that the respective rejections be withdrawn.

CONCLUSION

Applicants again wish to thank the Examiner for the courtesies extended during the telephone conversation on February 29, 2008. Based on the foregoing remarks and arguments, the applicants respectfully request reconsideration and withdrawal of the pending rejections and allowance of this application. The applicants respectfully submit that the instant application is in condition for allowance. Entry of the arguments presented herein and an action passing this case to issue is therefore respectfully requested. In the event that a telephone conference would facilitate examination of this application in any way, the Examiner is invited

to contact the undersigned at the number provided. Favorable action by the Examiner is earnestly solicited.

AUTHORIZATION

The Commissioner is hereby authorized to charge any additional fees which may be required for consideration of this Amendment to Deposit Account No. **13-4500**, Order No. 3620-4014.

In the event that an extension of time is required, or which may be required in addition to that requested in a petition for an extension of time, the Commissioner is requested to grant a petition for that extension of time which is required to make this response timely and is hereby authorized to charge any fee for such an extension of time or credit any overpayment for an extension of time to Deposit Account No. **13-4500**, Order No. 3620-4014.

Respectfully submitted,
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Dated: March 27, 2008 By: _____
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